CHRONOLOGY OF THE CONCEPT OF SYMMETRY AND ITS APPLICATIONS

C. 600 B.C.	Anaximander uses a symmetry argument to explain the stability of the world.
C. 250 B.C.	Archimedes discusses the principle of the lever in his book 'On the equilibrium of planes'.
C. 1350 A.D.	Buridan's Ass. A mediaeval sophism using a symmetry argument to ridicule the determinist views of Buridan (a similar conundrum was propounded by Aristotle in his work De Caelo).
1586	Stevinus derives the law of equilibrium on a double inclined plane.
1632	Galileo discusses invariance with respect to uniformly moving reference frames.
1703	Huyghens considers the laws of impact from the point of view of symmetry in his posthumous treatise 'De Motu Corporum ex Percussione'.
1713	Bernouilli introduces the Principle of Indifference in the theory of probability in his posthumous work 'Ars Conjectandi'.
1768	Kant uses a fallacious symmetry argument to disprove the relational theory of space.
1822	Fourier discusses the concept of scale invariance (also referred to by Galileo in 1638).
1828	Galois introduces symmetry groups in the study of algebraic equations (following earlier work by Lagrange and Ruffini).
1830	Hessel derives the 32 symmetry classes in crystallography
1845-1878	Cayley and Sylvester develop the theory of invariants of algebraic forms.
1848	Bravais analyses the 14 possible types of crystal lattice
1854	Cayley defines an abstract group.
1872	Klein's 'Erlanger Programm' expounds geometry as the study of symmetry.
1873-1893	Sophus Lie develops the theory of continuous groups.
1876	Loschmidt attacks Boltzmann's H-theorem using the time-reversal symmetry of classical mechanics.
1883-1892	Picard and Vessiot extend Galois's methods to the theory of differential equations.

1885-1894	Federov, Schoenflies and Barlow independently derive the 230 crystallographic space groups.
1894	Curie analyses the relationship between the symmetry of cause and effect (Curie's Principle).
1894	Cartan classifies the compact semi-simple Lie Groups (following Killing).
1896-1905	Froebenius, Schur and Burnside develop the theory of group representations.
1905	Poincaré investigates invariance properties of Maxwell's equations (following Lorentz).
1905	Einstein introduces special relativity.
1909-1910	Cunningham and Bateman discuss the conformal invariance of Maxwell's equations in free space.
1916	Einstein announces the Principle of General Covariance.
1917	Kretschmann criticises the physical content of general covariance.
1918	Noether expounds the relationship between symmetry and conservation laws in Lagrangian theories.
1924	Polya and Niggli describe the 17 symmetry patterns in a 2-dimensional Euclidean space (these were actually known independently to Federov, 1891).
1925-1926	Weyl discusses the representations of compact semi-simple Lie groups.
1928	Dirac's relativistic wave equation leads to the discovery of the spin representations of the Lorentz group (the existence of spin representations of the rotation group was known to Cartan, 1913, and was exploited by Pauli in his theory of electron spin in 1927).
1932	Heisenberg introduces isospin space.
1935	Fock analyses the degeneracy of the hydrogen spectrum with respect to angular momentum as a dynamical symmetry.
1937	Kramers defines charge conjugation.
1939	Wigner investigates the infinite dimensional unitary representations of the Poincaré group (which is neither compact nor semi-simple).
1954	Yang and Mills introduce non-Abelian gauge groups in particle physics.
1954	Lüders proves the PCT theorem, i.e., invariance of field theories under simultaneous inversion of space, charge and time.

1956	Utiyama extends the works of Yang and Mills to derive Einstein's field equations from a principle of gauge invariance.
1956	Lee and Yang suggest non-conservation of parity in weak interactions of elementary particles.
1957	Fock publishes his 'Three Lectures on Relativity Theory'.
1961	Gell-Mann and Ne'eman independently introduce the SU(3) classification of the hadrons.
1961	Goldstone discusses spontaneously broken symmetries and the associated existence of massless particles.
1964	Fitch and Cronin carry out experiments which suggest that time-reversal symmetry may be broken by weak interactions.
1964	Gürsey and Radicati, and Sakita, introduce SU(6) as a mixing of internal and space-time symmetries in particle physics by analogy with Wigner's 1937 SU(4) theory in nuclear physics.
1965	Coleman and O'Raifeartaigh prove the impossibility of a relativistic generalization of SU(6).
1967-1968	Weinberg and Salam use a spontaneously broken gauge symmetry to unify weak and electromagnetic interactions.
1969	Bjorken introduces scaling symmetry in deep inelastic electron-proton collisions.
1970	Glashow invokes SU(4) symmetry (charm) to explain the non-existence of strangeness-changing neutral currents in weak interactions (charm was originally introduced by Bjorken and Glashow in 1964).
1973-1975	Glashow, Weinberg, Politzer and others develop theory of quark interactions in terms of colour gauge symmetry (chromodynamics).